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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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SYMYX TECHNOLOGIES INC
LEGAL DEPARTMENT
3100 CENTRAL EXPRESS
SANTA CLARA, CA 95051

EXAMINER	
SODERQUIST, ARLEN	
ART UNIT	**PAPER NUMBER**
1743	

DATE MAILED: 12/14/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/801,390	BERGH ET AL.	
	Examiner	Art Unit	
	Arlen Soderquist	1743	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 September 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-183 and 186-190* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-183 and 186-190* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

1. Claims 1-183 and 186-190 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In claims 1 and 2, the fluid distribution system both supplies reactant(s) to the four or more reactors and takes the effluent to one or more effluent sinks. It is not clear if the flow partitioning subsystem or the pressure partitioning subsystem have any structural relationship or requirement relative to placement between the reactors and either the reactant source(s) or the effluent sink(s). In the same respect, it is not clear if there needs to be a one to one correspondence between the number of flow restrictors and the number of reactors. In addition it is not clear if there is any difference between the flow restrictors in the flow-partitioning subsystem and the pressure-partitioning subsystem since aside from being called differently the is no difference in the claimed structure. For examining purposes, the flow-partitioning subsystem and the pressure-partitioning subsystem will be treated as being met by four passive flow restrictors of different flow resistance connecting four reactors to either a source of reactant or an effluent sink (collection structure). Also relative to claims 1 and 2, it appears that a definite structural relationship is required for the feed-composition subsystem (it must be located between the reactant source(s) and the reactor). In claims 4-6, it is not clear if the four or more inlet/outlet flow restrictors are in addition to the flow restrictors of the various subsystems of claims 1-2 or are providing a definite structural relationship for the flow restrictors in one or more of the subsystems of claims 1-2. Claim 7 has the problems of claims 1-2 relative to the flow-partitioning system. In claims 8, 11-12 and 14, it is not clear if the claim can be satisfied with a single set of flow restrictors, if it requires two sets of flow restrictors (possibly equivalent to claim 6) or if there is a required order or structural relationship for the two systems. In claims 9, 11 and 13-14, since the feed composition-subsystem includes the structure of the flow-partitioning subsystem, it is not clear if the claim requires two sets of flow restrictors or simply the flow restrictors of the feed-composition subsystem. In claim 18 it is not clear how the structure is limited, if the limitation of claim 19 is the only way that the limitation can be met or what if any structural relationship (as found in claims 15-17) or additional structure is required for the claimed flow and pressure properties to be met. Claim 21 has the problems of claims 1-2 relative to the pressure partitioning system. Additionally it is not clear if the structure of claim 21 is different from the structure of claim 7 since the flow restrictor language is identical. In

claim 26 it is not clear if the outlet flow restrictors can provide a different pressure in each reactor without additional structure. In claims 64-87, 118, 122, 126, 130, 134 and 138 a plurality of selectable flow restrictors requires a means for their selection in order to provide a functioning device yet these claims do not provide and such means. In claims 172-174, it is not clear how the detection devices are connected to the other claimed structure. Claims 177 and 178 have the same structural problems as claims 1-2. In claim 186, "the cavity" does not have antecedent basis since there are four or more cavities claimed. Additionally, it is not clear how the cavities can be anything other than flow cavities. It is also unclear how the feed composition subsystem can function (provide a different feed composition to each cavity) with only four or more flow restrictors.

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. Claims 1-4,7-15, 21-25, 30-32, 35-36, 38, 43-44, 47, 52-53, 56, 61-62, 171-183 and 186-190 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hogan (newly cited and applied) in view of Calleja and Roberts (US 3,875,499), Brieva (US 3,753,653, newly cited and applied) or Finley (US 5,304,354, newly cited and applied) and Southgate (US 5,863,502). In the paper Hogan teaches an automated reactor system for catalyst research. A fully automatic microreactor unit for catalytic studies is described. The system provides the means for obtaining data on catalytic reactions quickly, accurately, and with a minimum amount of attention. It can be adapted easily to a variety of experiments, including reaction kinetics, catalyst screening, and

process variable studies. The unit employs a central master programmer to conduct unattended experiments with 6 reactors, and a high speed analyzer-integrator system to collect and analyze samples on command, and record the results on paper tape. Figure 1 shows the system with a single reactor being shown in figure 2 for a butene oxidation process. In the third paragraph under the "General Description" subheading (page D35) the system is taught as best suited to near atmospheric pressures (0-5 psig). This paragraph also teaches that different feed flow rates can be set for each reactor at the beginning of each run. Six different temperatures are also possible for the device. For most catalyst evaluations the volume of catalyst is taught to be between 1-4 mL and the feed flow rates are taught to be between 5-500 mL per minute. Figure 2 shows flow controllers prior to the reactor and a place where steam is mixed with the butane prior to contacting the catalyst. The figure also shows valves, motors and switches that are that are actuated by the programmer to control gas flow and other aspects of the device. Page D41 discusses the feed system including the flow regulators, valves, meters and tubing that can be easily rearranged to provide a variety of ways for selecting and feeding gases to the reactors. This system is capable of precise metering of the reactant gases and automatic alteration of flow patterns within the system. Flow rates are set with microregulating needle valves and flow patterns are changed using two- or three-way electric valves. The same page also discusses the furnace-reactor system and the sampling and analysis system. Figure 7 shows a typical program used to either screen exploratory catalysts or optimize promising catalysts. The program determines the initial activity (15 minutes of reactant contact) for all six catalysts at three different temperatures and the activity after one and three hours of reactant contact at one temperature for all catalysts. Hogan does not teach variation of other parameters or using a passive flow restrictor.

In the paper Calleja discloses a method for evaluating process conditions for converting syngas to hydrocarbons under the catalyst Co/HZSM-5 by conducting several experiments (tables 1 and 2; figs. 1-6; EXPERIMENTAL). The catalyst was prepared by the incipient-wetness impregnation technique from cobalt and thorium nitrate solutions using drying, calcination, and reduction conditions previously optimized (EXPERIMENTAL). The ZSM-5 zeolite was synthesized by an undisclosed procedure used in the laboratory. Since there is a concern with the reliability of the experimental data, such that a selected run is repeated three

times under the same conditions with the catalyst replaced in the reactor every time, one would expect that each of the catalysts in the reactors are prepared under substantially the same conditions. The feed gases (H_2 and CO) and carrier gas (He) were fed into the reactor, and products water and gasoline range hydrocarbon mixture were collected at the exit. The hydrocarbons of interest include those with at least six carbons (C_6+) whether they are aromatic, aliphatic, or olefinic. A factorial experimental design was used to establish the influence of process variables on syngas conversion. Suitable ranges of the variables were experimentally determined, and the ranges and values for the central point of the factorial design were deduced. Four experiments were carried out under the conditions of the central point of the design to determine the standard deviation of the experimental error for the objective function of yield and selectivity to C_6+. Considering the suitable experimental ranges in the orthogonal factorial design of experiments, sixteen experiments were carried out and the variables were defined in terms of statistical variables (table 1). The results were fitted to non-linear polynomial equations to express the yield and selectivity in terms of the first-order effects and all k-factor interactions. The curvature, which was confirmed by statistical analysis, shows that a simple two-level factorial design was inadequate to describe the dependence of the yield and selectivity on the variables. A higher-level factorial design was used to supplement the experimental design. A central composite design was selected, and a set of eight complementary experiments was carried out. From the experimental results, response surfaces or prediction equations for the yield and selectivity were obtained. Fig. 1 shows the response surface of yield with respect to temperature and pressure for fixed values of space velocity and CO/H_2 molar ratio. Each experiment involves controllably varying a set of reaction conditions, including space velocities, contact times, temperatures, pressures, and feed compositions and determining the conversion of CO and selectivity to C_6+ (abstract; tables 1 and 2; figs. 1-6; EXPERIMENTAL). The following tables illustrate the results from central-point experiments and supplementary experiments of complementary design.

Figure 2. Effect of Reaction Temperature on CO Conversion and C_6+ Selectivity

Experiment #	Temperature (°C)	Space Velocity (h^{-1})	CO/H_2 Feed Molar Ratio	Pressure (MPa)	CO Conversion (%)	C_6+ Selectivity (%)
1	240	0.9	1.2	2.1	11	38

2	280	0.9	1.2	2.1	33	30
3	320	0.9	1.2	2.1	62	8

Figure 3. Effect of Space Velocity on CO Conversion and C_6+ Selectivity						
Experiment #	Space Velocity (h^{-1})	Temperature (°C)	CO/H_2 Feed Molar Ratio	Pressure (MPa)	CO Conversion (%)	C_6+ Selectivity (%)
4	0.5	280	1.2	2.1	42	26
5	0.9	280	1.2	2.1	34	30
6	1.3	280	1.2	2.1	25	24

Figure 4. Effect of CO/H_2 on CO Conversion and C_6+ Selectivity						
Experiment #	CO/H_2 Feed Molar Ratio	Temperature (°C)	Space Velocity (h^{-1})	Pressure (MPa)	CO Conversion (%)	C_6+ Selectivity (%)
7	0.5	280	0.9	2.1	79	11
8	1.2	280	0.9	2.1	34	30
9	1.9	280	0.9	2.1	21	31

Figure 5. Effect of Reaction Pressure on CO Conversion and C_6+ Selectivity						
Experiment #	Pressure (MPa)	Temperature (°C)	Space Velocity (h^{-1})	CO/H_2 Feed Molar Ratio	CO Conversion (%)	C_6+ Selectivity (%)
10	0.1	280	0.9	1.2	19	0
11	2.1	280	0.9	1.2	33	29
12	4.1	280	0.9	1.2	35	20

Figure 6. Effect of Contact Time on CO Conversion and C_6+ Selectivity							
Experiment #	Contact Time (h)	Temperature (°C)	Space Velocity (h^{-1})	CO/H_2 Feed Molar Ratio	Pressure (MPa)	CO Conversion (%)	C_6+ Selectivity (%)
13	12	280	0.9	1.0	2.1	37	41
14	24	280	0.9	1.0	2.1	35	37
15	48	280	0.9	1.0	2.1	32	32
16	72	280	0.9	1.0	2.1	35	34
17	120	280	0.9	1.0	2.1	31	33
18	168	280	0.9	1.0	2.1	31	31
19	264	280	0.9	1.0	2.1	31	31

The CO conversion and C_6+ selectivity were determined from the graphs (figs. 2-6). As shown above, three different temperatures in experiments 1-3, three different space velocities experiments 4-6, three different CO/H_2 Feed Molar Ratios or compositions in experiments 7-9, three different pressures in experiments 10-12, and seven different contact times in experiments 13-19 were used. When the varied set of reaction conditions comprise at least three different space velocities and at least two different temperatures as shown in experiments 1-6, the determined conversion of a conversion-limiting reactant includes a range of values from about 11% to about 62%, which is from less than about 10% to more than about 50%. The range of conversion values spans about a 51% conversion difference. When the varied set of reaction conditions comprise at least three different space velocities and at least two different pressures as shown in experiments 4-6 and 10-12, the range in conversion is about 19% to about 42%, which is less than about 20% to about more than about 40%. When the varied set of reaction conditions comprise three different temperatures, three different space velocities, and three different feed compositions as show in experiments 1-9, the range of values is about 11% to about 79%, which is from less than about 10% to more than about 70%. Note that the language "comprising" is open language, such that at least three different space velocities, contact times, or combinations thereof, and at least two different temperatures, pressures, or feed compositions affords three different temperatures, three different space velocities, and three different feed compositions. This is especially true when six or more reactors are claimed, such that there are six or more experiments. When the varied set of reaction conditions comprise at least three different space velocities and at least two different contact times as shown in experiments 4-6 and 13-19, the range in conversion is from about 25 % to about 42%, which is less than about 20% to more than about 40% or about 10% to about 50%. The range of conversion values spans a 17% difference, which may be viewed as at least about 10% or 20% conversion difference.

In the patent Roberts teaches a gas detecting system. The purpose of the invention is to expand the capability/range over which the detector is usable. Column 1, lines 44-54 teach that the flow rate can be extended by using a variable orifice to vary the proportion of the gas sample reaching the detector. This is taught as having a problem in coordinating the gas ratio adjustment with the other adjustments made leading to possible error in calibrating and using the system. Column 2, lines 9-13 and columns 3-4 teach the use of discrete steps in the adjustment

of sample ratio by using fixed orifices of different sizes and valves to control the sample ratio. Column 6, lines 27-32 teach that the manner in which this is done simplifies the construction of the sample attenuator and still provides a large number of sensitivity positions.

In the patent Brieva teaches method and apparatus for gas phase chemical reaction analysis. In the device, a sample is divided into at least two parts by connector A_1, with at least one of the parts being passed through a chemical reactor prior to detection. Column 2, lines 38-48 teach that the connector divides the sample into two, three, or more parts with restrictors (B1, B2, and B3) controlling the flow of each portion. These restrictors are taught as capillaries or other type of fixed (passive) or variable restrictors.

In the patent Finley teaches a catalytic chemical reactor of a sandwiched configuration with at least one plate with a major surface and two minor ends opposite one another across the major surface. A plurality of reaction chambers are present in the plate, parallel to one another and the major surface, extending from one of the minor ends to the other. The reactor additionally comprises at least one heating panel adjacent and parallel to the flat plate. The plates may be configured in modular pairs with a heating panel in between each pair. The reactor is particularly adapted to produce organic chemicals, such as acrolein, in significant, but moderate quantities. Additionally, the reactor is of such a size that it is readily portable. Column 3, line 68 to column 4, line 11 and column 6, line 64 to column 7, line 3 teach that a separate respective capillary tube is connected at one end to a respective catalyst or reaction chamber inlet, and at the other end to a reactant supply pipe, which supplies a mixture of reactants to each catalyst chamber inlet through a respective capillary tube. These capillary tubes are fed by a common header containing pressurized mixed starting materials. This arrangement uses frictional drag in the tubes to control the flow rates through each of the separate reaction chambers. Although capillaries are preferred for flow control, other devices, such as orifices or adjustable valves, may also be used.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the reactor system of Hogan with a fluid distribution system capable of performing the different reactions taught by Calleja because of the ability to characterize a catalyst as taught by Calleja in an automatic and efficient manner with multiple reactors as taught by Hogan. It would have been obvious to replace the conventional flow controllers of

Hogan with fixed flow restrictors as taught by Brieva, Finley or Roberts because of the reduction in possible error compared with a variable restrictor, the simplification of construction as taught by Roberts and the preferred use of capillaries for that purpose as taught by Brieva and Finley.

4. Claims 5-6, 16-17, 19-20, 27, 29, 33-34, 37, 39-42, 45-45, 48-51, 54-55, 57-60, 63, 88-121 and 142-171 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims. The art of record fails to teach or fairly suggest the combined structure required by these claims.

5. Applicant's arguments with respect to the claims have been considered but are moot in view of the new ground(s) of rejection. The newly cited and applied Hogan reference is clearly intended for use in the Calleja type of process optimization situations and clearly teaches that the flow rate to each reactor can be set to different values. The Roberts reference provides motivation for using a fixed orifice in place of a variable orifice (conventional flow controller) and the newly cited and applied Brieva and Finley references clearly show a capillary as a preferred flow restrictor used to control flow in reaction devices. The new clarity questions resulted from a reevaluation of those claims. It is noted that some claims dependent from claims that are indicated as being allowable if the clarity issues were overcome are not indicated as being allowable. In these claims there is generally a required structure clarity issue that was solved in a claim dependent therefrom. In these situations examiner has only indicated the claims that contained adequate structure to be allowable.

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The additionally cited art contains related patents and art relevant to gas feed or parallel reactor systems.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Arlen Soderquist whose telephone number is (571) 272-1265. The examiner's schedule is variable between the hours of about 6:30 AM to about 5:00 PM on Monday through Thursday and alternate Fridays.

A general phone number for the organization to which this application is assigned is (571) 272-1700. The fax phone number to file official papers for this application or proceeding is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished

applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Arlen Soderquist
Primary Examiner